Thesis/ Reports Lang, D. M.

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RECORNAISSANCE

of the

KAIBAB HATIONAL FOREST

by

D. M. Lang. Assistant Forest Ranger

and

B. B. Stewart. Forest Assistant

MAP

by

N. B. Makbo. Forest Agent.

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Chapter I.

PERSONNEL

Late in the fall of 1909 Lumberman Secry was sent to northern Arizona to make a preliminary examination of the Kaibab National Forest. Accompanying him were representatives of the Utah Southern Company who made this examination to determine the feasibility of constructing a railroad from some point on the San Pedro, Los Angeles & Salt Lake Railroad, to end somewhere on the rim of the Grand Canyon, and to look into the available supply of timber on the Forest.

The members of the company present were favorably impressed with the forest resources such a road would tap and accordingly it was then definitely decided to make a reconnaissance of the timbered area on the Forest.

The reconnaissance party left Ogden January 13 and reached Kanab Forest headquarters on the NOth. Some little delay was caused by the provisions which were shipped from Ogden not reaching Kanab, so that the party finally reached the Forest February E. Here another delay was caused by snow being too deep to haul previsions by team, and all of the supplies had to be hauled by hand on dog sleds to Jacob's Lake from the edge of the Forest, which was as far as teams could be used, so that when the field work was actually begun. it was February 15.



Photo. 88909. Ranger's Meeting at Ryan Ranger Station. April 11 - 13, 1910.

The following statement gives the names of the members of the party and the time spent by each on field work.

D. M. Larg. Assistant Forest Ranger.	Jenuary	13	to	September	15
N. B. Rokbo, Porost Agent.		111	199	•	
S. S. Stewart, Porest Assistant.			**		**
J. E. Ingram. Forest Assistant.	•	**	**		**
R. W. Taylor, Forest Assistant,			"	July 23	
Lincoln Orowell, Forest Assistant,			**	May 12	
William Maco, Forest Ranger,		. **	m	May 1.	
A. L. Griffin, Cook		**		September	15
R. Rosenbluth, Forest Assistant.	March	25	- 11		"
Carlos Judd, Teamster,	May	1	**	•	*
J. B. Saston, Forest Assistant,	July	19	"	ő	11
Dana Parkinson, Forest Assistant,	July	19	* **		10
L. E. Hitchcock, Forest Assistant,	July	19			*

The work accomplished by the party amounted to mapping and estimating approximately 412,000 acres of timberland, besides surveying 35 miles of Transit line and 195 miles of compass line.

Cost.--

The cost of the field work is as follows:

Salaries -	\$5,352.52
Supplies and Equipment -	1,680.39
Travel -	1,366.89
General expenses including temporary labor -	763.50
Notal -	\$9,163.30
Cont was never 0 000	



Photos 87293 and 90712.

Illustrating different methods of traveling snowshoes versus skiis.



Chapter II.

The Kaibab National Forest is located in northern Arisona along the Colorado River, on the Kaibab Plateau locally called Buckskin Mountains. It contains an area of 1,087,450 acres, and is about 50 miles long and 35 miles wide. This is one of the oldest Forests in the country, having been created by President Harrison, February 20, 1893. Along the south border is the famous Grand Canyon of the Colorado; the Colorado River being the southern boundary of the Forest.

The timbered area, the only part of the Forest covered by the Reconnaissance party is situated on a level plateau out by innumerable dry runs or canyons. The formation consists of alternating layers of lime and sandstone. Lime stone forming the top layer except where it has been removed by erosion. The elevations range from 5,500 feet at the base of the plateau to 9,200 feet at its highest point. This plateau is surrounded on all sides except the south by desert land. Settlements -

The surrounding country is sparsely settled. North of the Forest a distance of 35 miles are two small towns located on Kanab Creek, namely Fredomia in Arizona and Kanab just across the boundary in Utah. Kanab has a population of



Photo. 91838. Junction of Kanab Creek and the Grand Canyon of the Colorado, forming southwest corner of the Perest.

500 people and Fredomia 300. The inhabitants of these two small towns are the principal users of the Forest, with the exception of the Grand Canyon Cattle Co., whose headquarters are east of the Forest in House Rock Valley.

INDUSTRIES

In a country so sparsely settled as this, it is not to be expected that any very large or extensive industries would be found. There are four industries carried on by the people of this community—Stock raising, farming, mining, and lumbering. Of these four industries stock raising is by far the most important, and even this is not carried on in a very extensive manner. The largest single grazer on the Porest is the Grand Canyon Cattle Co. This company grazes more than 2/3

of the total number of cattle grazed on the Forest; in fact, this company is the only one in this community that actually alone depends upon stock raising for its income. The balance of the population grazes only small herds of cattle and a few head of horses. Sheep grazing is also indulged in, to a certain extent. Last season the total number of sheep grazed upon the Forest amounted to 5,000.

Farming, the second industry in importance, is confined to the immediate vicinity of Kanab and Fredomia. The principal crop is alfalfa. Some little garden truck and fruit is also raised. The water used by these communities does not come from the Forest but from Kanab Creek which has

Photo. 86975. Jacob's Lake Ranger Station. Photo. 86973. Cattle watering at Jacob's Lake. its source in the Sevier Range. In fact there is not a single stream issueing from the Forest except below the rim of the Plateau into the Colorado River.

At present it is confined to doing assessment work on the nonpatented claims. The Cocomino Copper Co., at one time operated a smelter and leaching plant at Ryan. This plant had been closed down for several years.

The Petoskey Mining Co. also at one time operated a plant in Warm Spring Canyon. This plant was entirely destroyed by fire several years ago. There are several other groupes of claims on the Forest on which the assessment work is being done.

Lumbering at present could scarcely be called an industry, nor has it ever been carried on in a very extensive
manner. There is at present only one small steam power mill on
the Forest with a daily capacity of 5,000 feet. This mill during
the last season probably out 75,000 feet of lumber.
Future Development --

What the development of this country will be in the next few years if a railroad is constructed to connect it with outside markets is impossible to foretell. The scenic effect of the world famous Grand Canyon is unsurpassed, and yet there are thousands of people in Utah, Idaho and surrounding states that have never seen the canyon. This one thing would undoubtedly bring thousands of people to visit this vicinity.

The plains north and west of the Forest are staked off in oil claims, there are also immense deposits of coal which could be exploited by spurs from the main line. There are thousands of acres which could be put under cultivation by irrigation, besides the industries before mentioned which undoubtedly will be increased ten fold with a railroad as means of conveyance to outside markets. Taking into consideration the Natural resources of this country it is impossible not to be optomistic about its future development.

Chapter III.

FOREST DESCRIPTION

body of mature timber occupying the top of the Kaibab Plateau and merging gradually into the mahogany and sage brush as the elevation decreases. The main body of merchantable timber, in detail, is frequently intercepted by irregular areas entirely free of tree growth,—parks, broad canyon bottoms, dry southern exposures, and in many cases ridges, the latter especially near the exterior limits of the forest. This unequal occurrence of the forest cover is due to a number of agencies, chiefly fire and lack of moisture.

The main physical factors, topography and moisture with the possible assistance of exposure determine the forest types. Thus we find the woodland type at the lowest elevations

composed of pinons, junipers, scrub oaks, mountain mahogany and other drought residing chaparral species; a yellow pine type in somewhat moister situations and generally at higher altitude; next a mixed type mainly spruce and balsam but with considerable Douglas fir mixing in on the drier sites. This mixed type first appears along the north and northeast-orn exposutes at an approximate elevation of 8,000 feet and as the elevation increases the type extends up the slopes and further back on the ridges, occupying practically all of the area above the 8,800 foot contour except south and southeastern exposures which support a fair stand of mature yellow pine.

Considerable variation exists in the pine and mixed types such as large open and park-like areas, the presence of Douglas fir (Pseudotsuga taxifolia) and large tracts of aspen (Populus tremulcides) or the presence of balsam and spruce over typical yellow pine sites. Such variations should not be confounded with true types, since the physical factors of soil, moisture, exposure, climate, etc., are identical with those prevailing over the true types.

Woodland Type.

The woodland type covers all the foothills, low ridges, mesas, dry slopes and the semiarid tract between Little Mountain and Kanab Creek Canyon comprising approximately 50% of the total area. The forest is very irregular, patchy and consists principally of clumps of pinon pines (Pinus edulis)



Photo. 88914. Illustrating best quality of mature yellow pine with understory of saplings and poles.

and juniper (Juniperus Utahensis and Juniperus scopulorum). Mature trees are brushy, crooked and have little commercial value.

Yellow Pine Type.

The yellow pine type comprises approximately 25% of the total area in the forest but forms over 80% of the merchantable timber. Below 7500 feet elevation it occurs mainly on northern exposures extending back to the crest of the ridges where it meets the woodland type. Above 7500 feet the occurrence changes gradually, yellow pine replacing the woodland type on the southern exposures and itself giving way to Douglas fir, spruce and balsam on northern exposures.

The pine occurs mostly in open stand park-like or even isolated in character. Much of the merchantable stuff is over-mature and is rapidly depreciating in quality. The stand embodies all age classes in varying density and proportions, but nowhere fully stocked, the old trees fairly uniformly distributed among the young growth over which they tower with large spreading crowns, rubbing the growing stock of soil moisture and light and themselves producing little or no increment value.

Douglas Fir Sub-type.

Limited areas exist in the yellow pine type where the physical factors determining types serve to favor Dauglac fir and here this species is found predominating or competing



Photo. 91835. Southwest edge of timber. Showing Juniper. Pinon, Mt. Mahogany and Yellow Pine.

most suitable to associate with yellow pine taking the moist sites where pine meets severest competition with the inferior species. Much of the fir is mature and deteriorating in quality. Considerable reproduction occurs appearing healthy and vigorous, indicating that the type might be extended to advantage, into the territory of the spruce and balsam.

Aspen is everywhere prominent in this region and is a valuable associate of Douglas fir, being exceedingly active in restocking burns, where its light foliage produces ideal light and moisture conditions for fir reproduction.

Spruce-balsam or Mixed Type.

The spruce balsam type perhaps more appropriately called mixed type from the nature of the stand is composed of spruce (Picea Engelmanni and P. parryana), balsam (Abies concolor and a little A. lasiocarpa), Douglas fir and considerable yellow pine. This type occupies only northern aspects up to 8,800 feet elevations where it extends over the ridges. Occasionally large veteran yellow pine occur among the balsam and spruce, strong evidence that the primeval forest was pine. It is thought that the mixed type has succeeded the original yellow pine on account of the cumulative effects of severe fires, and is still advancing upon it.

The stand on an average is younger than the pine and often large areas of pole sizes exist. The composition of the mixed type is largely temporary in character since

much of the Douglas fir and yellow pine will eventually be crowded out by the more tolerant balsam and spruce. Blue spruce forms a large proportion of the merchantable stand, but is of very inferior quality, many of the trees being infected with butt-rot.

Stand Tables.

The detailed results of the valuation surveys are shown by types in the following tables. The junipers and pinon were not considered important enough to deserve any attention and the Douglas fir subtype mentioned in description is too small to warrant individual consideration.

The valuation strips were selected as near as possible to represent average stands, all trees were calipered down to 6" d. b. h. and in a number of instances seedlings and saplings were counted. In the yellow pine type the table shows the average stand per acre for all species over 6" in diameter on 500 sample acres and in the mixed type the average stand per acre for 123 scree.

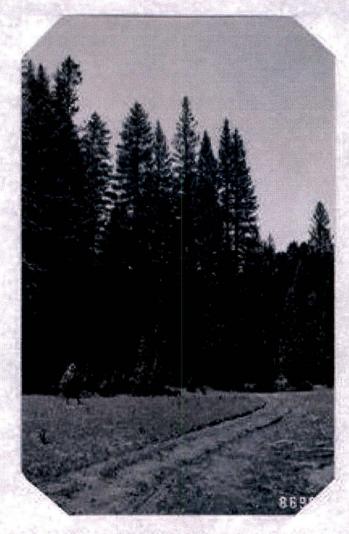


Photo. 86983. Mature stand with reproduction in foreground. Mixed type.

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Photos. 86980, 86981.

Illustrating typical mixed stands along the main ridge west of Big Park.

		Yel Pine	.D.fir	:Balsam	:Spruce	:Total
:Seedlings Average of: 0' - 3' high		4.56	3.98	: 27.35	: 4.18	: 40.07
:Saplings 3' hi	19.97	6.21	: 53.67	:18.16	98.01	
	:Dier					!
	: 6	2.32	.89	1.60	1.44	6.25
	7	.96	.46	1.10	.71	3.23
	8	1.71	.62	1.46	1.02	4.81
	9	1.43	-67	.85	.52	3.47
	:10	1 1.57	.61	1.27	.71	4.06
	111	1,16	.24	.64	.21	2.35
	:12	1.34	.50	.96	. 56	3.36
	:13	1 .82	.23	· m	.31	1.57
Total to 14" B.B.H.		11.31	4.22	8.09	5.48	: 29.10
	:14	1.46	.28	.97	1.14	: 3.85
位于 医下层 医皮肤 医皮肤	:16	: 1.02 :	.09	: .86	: .88	: 3.70
	:17	1 .41 :	.04	: .07	1 .02	: .54
	:10	: .73 :	.61		: .70	: 2.67
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	124	: .45 :	.18	: .26	: .03	: .98
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	:36	: .06 :	.02			: .12
	:38	: .01 :		: .01		: .00
Total	:40		.01		105.33	: .01
		18.51	7.80	: 12.36	: 8.88	:47.55

List of Coniferous Trees Found on the Kaibab National Forest.

Scientific Names	Common Name	Local Name
Pinus ponderosa	Western yellow pine	Yellow pine, longles
Pinus edulis	Pinon Pine	Pinon
Pinus nonophylls	Single leaf pinon	Pinon
Pseudotsuga taxifolia	Douglas fir	Red pine
Picca Englemanni	Engelmann spruce	Spruce, apruce pine
Picca parryana	Blue spruce	Spruoe
Abies concolor	White fir	Balsam
Baies lasicoarpa	Alpine fir	Bal san
Juniperus Utahensis	Utah juniper	Cedar, Juniper
Juniperus scopulorum	Rooky Mountain Red	Red Cedar
Juniperus communis	Dwarf juniper	Junipor



Photo. 88913. Illustrating the characteristic grouping habit of western yellow pine.

Chapter IV.

LUMBERING

Logging:

Logging was first commenced on the Kaibab Bational. Forest about 15 or 20 years ago. This logging was done in Bail Canyon; the only remaining sign of this operation is the old stumps and tops. This operation did not in any way deplete the stand of timber even in its immediate neighborhood; in fact this was such a small operation that the effect upon the Forest is not noticeable.

In the old days the logging was of the crudest kind, and even now the nethods used are very simple. A mill crew consisting of from six to eight men do all of the sawing and logging. When the crew commences operations in spring they immediately start logging, after logging enough to last the mill a few weeks, sawing commences. Thus the same crew is alternately logging and sawing throughout the summer. The only present operation on the Forest is in the neighborhood of Jacob's Lake. This is a small operation cutting 5 M ft. per day. This operation as carried on since the creation of the Forest is in good shape. Brush is well piled, stumps are cut low and tops well utilised.

The future development of lumbering on the Kaibab National Forest hinges entirely on a means of conveyance to outside markets. The present demand is only in proportion to the present growth of a community, which is practically

-14-



Photo. 87291 and 87292.

Reconnaissance party. Moving camp, also showing cutover lands in the vicinity of Jacob's Lake.

at a standstill, this demand will not even use the amount of timber which is going to waste through depredations of insects, and other causes. Having in view the future well-fare of this community as well as the Forest it is thought that every reasonable effort should be made to get a rail-road into this country as a means of conveyance for not only the natural resources of the country, but the farm products as well.

This Forest presents a very attractive logging proposition. After a railroad has been constructed across the plateau, the main objection will have been overcome. The plateau as before stated is practically level, spurs can be built at very little cost, there is practically no underbrush over the greater part of the area, which abolishes the necessity of swamping. The timber is open and for this reason no triming out would have to be done to make skidding roads. etc. It is believed logging can be done more advantageously by team than by steam skidding. However, steam loaders, it is believed, could be used very advantageously, and perhaps a combination loader and skidder could be used to even better advantage. It is believed that the season is too short here to make logging on snow a paying proposition. This of course, will depend upon the company doing the logging, but it is thought advisable to outline some method so that a person reading the report could get a good idea of the country from the description and methods outlined.

The principal trouble that will be experienced in carrying on an extensive logging operation on the Kaibab is the lack of water, there are very few springs on the Forest and no streams issuing from it. The melting snow instead of running from the Forest in the form of streams seeps thru the loose gravelly soil to come out several thousand feet below the Rim of the plateau in the form of springs and flow south into the Colorado River. There are a few springs on the Forest which would furnish water for camps, etc. But it will not be possible to always locate camps in the immediate vicinity of springs, so the greater part of the water for a large operation would have to be hamled.

TRANSPORTATION

The Forest has absolutely no outlet except by road as it is some 150 miles from the nearest accessible railroad point.

The work on roads and trails is being pushed, as far as allotments will permit. As the Forest is level road building except in special cases is fairly easy.

Sammills:

There is only one sawmill on the Forest. This mill is located at Jacob's Lake and has a daily capacity of 5000 feet. This is a steam power mill operating one circular saw, to which, in the past few years has been added a planer



Photo. 86979.

"Big Park Ranger Station"

Path and shingle mill. The mill operates during the summer only, and as the sutput is demanded by the local market. Rough lumber is sold for \$15.00 per M.; dressed lumber for \$18.00 to \$24.00. Output is not graded. Cost of logging, sawing, etc., is as follows: Felling and sawing into log lengths, \$1.50; skidding and hauling, \$2.50; sawing \$5.00; stumpage, \$1.00. If dressed lumber is desired, add \$2.00 for planing.

Labor is scarce and demands a correspondingly high scale of wages. If a large lumbering operation is ever started on this Forest labor would have to be brought in from some other part of the country.

Chapter V.

MANAGRMENT

Objects.

The forest under consideration is this report presents a variety of conditions; is so irregular in density, age classes, and quality of timber represented that the usual objects of management must be sidestepped and all efforts directed to securing some soft of silvicultural order. Over practically the whole forested area overmature timber is found, ranging from moderately dense stands to included trees and accompanied by patchy unevenaged reproduction; areas subject to excessive drying alternate with areas of proper moisture requirements; poor species are occupying

wery small proportion of the forest do anything like normal conditions prevail.

The objects, then, to aim for in the first cutting are the removal of the overmature trees, the bug-killed timber and undesirable species (blue spruce and balsam), the establishment of a more uniform stand, proper moisture conditions, better soil cover and as near as possible absolute protection from fire.

Protection.

The forest naturally has many enemies of which fire and insects are the worst. The place of sheep grazing, so often the source of much difficulty, is here taken by horses and cattle, and generally very little harm is done. Windfall, snow break and fungi are minor factors, causing very little damage. Ploods are only to be reckoned with occasionally and are local in occurrence. The mistletoe pest is quite prominent and in many of the drier ridges is the source of considerable injury, particularly to yellow pine in sapling and pole classes.

Fires

Porest fires have been the cause of incalculable losses both from the quantity of actual timber consumed and the fertility wrung from the soil. Vast denuded areas, charred stubs and fallen trunks and the general, prevelence of blackened poles seem to indicate their frequency and



Photo.86984 Illustrating treeless character of Canyon bottom and Spruce-Balsam coming in under aspen on northern exposure of cld burns. severity long before this country was explored by the white men. Recent history shows that a very great number are caused by lightning and it is reasonably fair to attribute many of the old fires to this cause. Being a great game country it was undoubtedly frequented by Indians who set fires to aid in their hunting expeditions. Aside from the destruction and resultant fires by lightning, which is everywhere evidenced by shattered trunks or dead standing trees, the origin of recent fires may be attributed to carelessness of stockmen and campers.

The old fires extended over large areas at higher altitudes, amounting to several square miles on either side of Big Park and to numerous smaller irregular areas over the remainder of the forest. Evidence indicates light ground fires over practically the whole forest, some of the finest stands of yellow pine show only slight charring of the bark and very little damage to poles and undergrowth. The real damage results in the destruction of ground cover, reproduction and humus in the soil.

Insects

Insect infestation has attained enormous proportions over the whole forest and the injury is going on
steadily year after year. The old fallen trunks, existing
in all stages of decays argue that this pest has been working
for many decades, probably hundreds of years, and the extent
of damage wrought is unequalled, even by fire. As a rule





Photo. 8698E. Insect infested tree. Photo. 91833. Scattered and limby

Photo. 91833. Scattered and limby yellow pine in Indian Hollow. (Bottom of Canyon.)

bug-killed trees occur in patches, ranging in extent from a few trees to several acros. The largest single area is located on Greenland Point and approximates 80 - 100 acres. The exact location of the most serious infestation is a questionable matter. The estimate shows the larger amounts of merchantable timber killed in Tps. 36 and 37 E., R. 3 E., but this is misleading since only standing trees above 18 inches D.B.R. were included in the estimate, while in other places, mainly on the ridges, large quantities of poles below the diameter limit were noticed, as well as large patches where practically the whole stand littered the ground.

fungi begin to work about their bases and after a w hile they yield to the winds. The trees when killed remain sound and standing for several years and in this condition can be utilized the same as green timber, but after fungi have worked enough to cause their fall their value for lumber or any other purpose is gone and they become a fire menace to the forest.

Grazing

The problem of grazing in its relation to silvicultural conditions seems to hinge about the one primal object of bringing about such utilisation of the soil products as will result in the largest returns possible. without injury either to the growth of the forest or to the forage on the area grazed. Bacause of the vital importance of grazing to the industrial or economic development of this region, total exclusion of stock would evidently be unreasonable; it would take from the settlers in the adjacent valleys an occupation which is at the present time their greatest income producer and financial support; it would diminish the income producing power of the forest and defeat one of the chief aims of forest administration, namely, "That all land is to be devoted to its most productive use for the permanent good of the whole people."

There are numerous areas of typical grazing land - parks, broad canyon bottoms, and southern exposures scattered throughout the timbered area which can be made to yield a fair income, but which by nature of their distribution are so intimately related to the timber area that segregation of either is impossible without injury to the interests of the other. Many such areas have been treeless for all time and will probably always remain so.

The Kaibab furnishes much valuable summer range and it is believed its use can be controlled so as not to conflict with the timber interests of the forest.

.The position now taken by grazing is confined chiefly to cattle, a few hundred wild horses (500 -600) and about 5,000 head of sheep. The sheep are allotted to a small area extending over the northwest corner of the



Photo. 91834.
Winter range west of Little Mountain.
(Luxuriant Brome grass and others)

main plateau, approximately from the east edge of the mountain, north of Jacob's Lake westward, and from a line between Jacob's Lake and Three Lakes westward to Baefle Canyon, comprising approximately 52,000 acres or an allotment of 10 acres per head.

The few hundred horses graze in scattered bands practically over the entire mountain. In addition to the wild bands approximately 300 - 400 saddle horses owned by the Grand Canyon Cattle Co., and West Side grazers find range. Most of the saddle horses are confined to fenced pastures or herded during the "round up" season and hence form an inconsiderable factor in the grazing proposition.

Cattle probably always will as at present, be the predominant feature in grazing on this forest. The semiarid condition in the neighboring valleys and limited water supply for irrigating purposes make cattle raising a necessary and valuable adjunct to farming. In fact an unusually large proportion of the communities' interests and resources are directly dependent upon grazing, and their prosperity and further development rests upon the proper use of the range.

As to the relative amounts of injury which grazing animals bring to the forest, opinions differ considerably.

Horses and cattle do very little harm when they roam at will and do not exist in too great numbers. The present allotment, fixing the summer range, which is the only one affecting forest conditions, at 400,000 screes and dividing by the 14,000 head of horses and cattle grazed, for which permits were given.

brings the allotment to approximately IS acres per head. This does not mean that the stock is evenly distributed in this proportion over the entire forest. As mentioned above, typical grazing areas exist throughout the range and since springs or pends are usually within or near such areas the stock naturally graze in their vicinity, or drift back into the forest some distance returning every day or so for drink and salt. The only damage of any significance resulting from horses and cattle is by trampling but this is minimized over the forested area by the fact that they graze singly or in small groups. Tramping by speep is a different matter. Moving in more compact bands their sharp hoofs out and mangle many of the tender seedlings and while some may recover, the harm done lies in retarded growth and subsequent crooked and deformed beles.

Silvicultural Methods - Cutting System.

Practically the only cutting system that can be applied on this forest at present is the selection method. This was chosen for several reasons. The market conditions have been, and even with a railroad will be such that only a limited class of trees can be out at a profit. In an all-aged virgin forest the intermediate sizes produce more value from an increment standpoint than could be realized by cutting under present market sonditions. The first object in all silvicultural management is to obtain the largest amount of timber in the shortest possible time and in order to bring



Photo. 88908. View of the junction of Kanab Creek and the Colorado River from Little Mt.

about this ideal situation a goodly amount of thrifty trees must be left. No hard and fast rules can be formulated for each individual type but general suggestions modified to suit detailed silvicultural conditions can be made to cover extensive areas. The very irregular distribution and lack of uniformity in age classes demands that the first cutting amount to a culling or perhaps better an improvement cutting. This should aim to remove all large, mature, partially defective trees, thin out the denser stands but not remove any trees where the forest cover is at present very open or scattered in character. In fairly dense stands where a good representation of saplings, poles or standards are present all trees included in the estimate can be removed. While the estimate for the various species was made to definite diameter limits, this practice should not be strictly adhered to in marking or cutting, but the judgment of the forest officer exercised so that vigorous, healthy, rapid growing trees be left rather than the old stunted specimens. even though the latter be below the diameter used in preparing the estimate.

Under the above cutting system it is believed that an average of 3 M. ft. per acre can be cut from the entire timbered area. It is not meant to imply that 3 M. ft. can be cut from each and every acre but that each different acre will present a different problem, from some acres not more than 500 feet can be cut, from others 10 or 12 M. ft. But that the average for the entire Forest will be at least 3 M. feet per acre.

Woodland Type

In the woodland type cutting will always be a small operation and can never amount to more than the removal of a few cords of wood or a number of posts per care.

Yellow Fine Type

Practically all of the yellow pine type is open and any cutting system must guard against increasing this character to a dangerous degree. By cutting only the mature pine, leaving black jacks and thrifty yellow pine scattered fairly uniformly, the density will be regulated and natural conditions only slightly modified. This helps control the physical factors of wind, frost, soil and air, moisture and light, thus tending to bring about normal forest conditions in the shortest possible time.

Douglas Fir Subtype

In this mixed type where Douglas fir and yellow pine are the principal species, cutting out the Douglas fir on typical yellow pine sites is thought advisable, but where the physical characters appear to encourage balsam and spruce, Douglas fir should be favored as this species is better able than yellow pine to maintain itself against the inferior species.

No diameter limit can be chosen for a basis in marking Douglas fir. The character of the stand or its composition will always be the criterion to determine the amount to cut. As with yellow pine over cutting will allow the soil to dry out and so hinder reproduction and lessen the rate of growth of the remaining stand.

Spruce Balsam Type.

The principal aim in cutting over this type is to remove all the trees of merchantable size that can be forced on the market. It is thought by cutting the blue spruce and balsam clean that the composition of the present stand can be largely changed to Engelmann spruce and Douglas fir. Some fir and Englemann are found over the greater part of the plateau above an elevation of 8,500 feet. In marking after the improvement cutting idea the very old trees of the better species can be removed providing enough thrifty poles or standards capable of producing seed are left to insure the propagation of the stand.

Brush Disposal

The methods of brush disposal, if made flexible to suit the varied conditions, will better satisfy the silvicultural needs of the forest. Generally the stand is very open, made up of mature trees in mixture with a fair amount of reproduction, in scattered clumps, and not infrequently considerable stretches of open ground with the mineral soil exposed. Over the greater part of this forest the soil be comes very dry during the dry season and this checks the growth of the young stock or prevents it from getting started at all.

In the woodland type the soil is loose and considerably exposed. Any measure tending to conserve soil moisture is obviously the one to practice. Lopping and scattering the



Photo. 88907. Open or park like yellow pine stand found near exterior limit of yellow pine typ... West side of Little Mt.

few tops which would result from small isolated cuttings would not seriously increase the fire danger and yet go a long way in preventing erosion and conserving soil moisture. The ground cover and undergrowth are usually so slight as to eliminate the necessity of fire lines.

In the yellow pine type a variety of conditions exist and the proper method for handling the brush depends upon the nature of the stand, the character of the reproduction and ground cover. Since a given set of conditions holds only for small irregular areas, the method should vary to conform to the silvicultural conditions of each area. For example, broad flat ridges occur where the old trees are isolated, the mineral soil very much exposed and subject to excessive drying of the top layers of the soil. Such areas are numerous and support practically no reproduction. Other situations occur where the stand is moderately dense with little or no undergrowth or reproduction. A fair soil cover of needles and humus is present making an ideal seed bed for yellow pine seed. Here it is thought logging and scattering will be most practicable. Again mature trees occur among good patches of saplings and poles where burning might destroy much young growth. Filing in small compact piles would be comparatively safe providing fire lines 75 or 100 yards wide were burned around such areas. After logging there will be extensive areas with but little of the old stand left, but a fair amount of "blackjacks", poles and saplings isolated or in groups to form the basis for a

between the groups are often numerous small seedlings 2 - 4 inches high which should profit by the increased light providing sufficient soil moisture can be maintained. In this case careful lopping or scattering of the brush will shield the little trees from the direct heat of the sun and what is equally important the needles and broken twigs will form a soil cover which checks evaporation and invites further seed germination.

The Douglas fir subtype is composed of varying proportions of Douglas fir and balsam, a little spruce and yellow pine. Usually the stands are moderately dense with small amount of ground cover and fair reproduction. pacticularly of the inferior white fir. The menace from fire is especially great while the leaves remain on the brush which generally covers a period of two years. After their fall the danger is lessened. Douglas fir does not reproduce well over burned areas, besides the soil cover is destroyed. From a reproduction standpoint, burning should be avoided and the brush lopped in open stands or piled. where young growth is abundant, in small compact piles away from living trees. As a protective measure enough piles to form fire lines of effective width (75 - 100 yards) can be burned around ressonable areas (approximately 40 - 60 acres). Occasionally, as over broad flat ridges where the mature trees are scattered, lopping and scattering is considered most

feasible. In practice much must be left to the judgment of the man in charge since it is impossible to cover the various details in a report that are bound to confront the man in the field.

The spruce-balsam type comprises thick stands of spruce with all ages and sizes represented as well as a large proportion of white fir and frequently considerable Douglas fir. The danger from surface fires is relatively small as witnessed by the smaller per cent of spruce a burned over, but with the opening of the present stand and the subsequent increased drying such danger will become intensified. The spruce and balsam reproduction, especially the latter, often forms a heavy undergrowth and it is that this green cover will suffer much damage if the brush was piled and burned, whereas lopping and scattering evenly over the ground will allow it to be weighted down by the snow and rot much sooner than if left in piles.

Forestation

Reproduction from an aconomic standpoint is essential, as upon this one factor more than any other rests
the earning power of the forest. To obtain best results
perfect restocking must be sought for, likewise those
species in composition which will produce best quality of
wood products and eventually command highest prices.
Throughout the different types, considering the Forest as a
whole, reproduction is fairly well represented by the

Photo 85682. Showing Big Spring Ranger Station and the rugged slopes of Nargle Canyon, also the generally tree-less character of the large canyon bottoms.

different age classes. On account of the forest's geographical location usually dry years are to be expected when young seed-lings will suffer, and this is especially true of the yellow pine along its lower altitudinal limit. Among the open stands around the woodland border of the type, the tops of ridges and southern exposures, yellow pine seedlings are rare. At higher elevations and over the remainder of the plateau the establishment and maintenance of a forest cover will generally be an easy matter. Good reproduction is patchy and scattered so that any attempt to describe such reproduction by locations is obviously impracticable. Its characteristic occurrence in even aged groups, the groups varying in age and density, prevail, except that small seedlings occur under the mature forest in abundance and fairly evenly distributed over large areas.

It appears that seedlings endure the shade for a while but suffer unless the parent trees are removed. The most thrifty reproduction occurs in the openings and seems to indicate that with the seedlings once established a fair amount of the present stand only would be necessary to protect them from drying winds and provide a future means for reseeding in case of fire.

The artificial reforestation of bare areas is believed to be impracticable at present on account of the poor economic development of the surrounding country and the consequent scarcity of labor. Matural reproduction can probably be secured more cheaply.



Photo 88910. Camp at Three Forks. Note the very open forest cover on southern exposures, also the general absence of reproduction.

Annual Cut

With the chief objects of management in view, the advisability of formulating a rotation system or fixing a definite amount to be out annually appears obviously impracticable at this time. Such a plan requires extensive and reliable growth data applied to fairly accurate stand tables. The absence of lumbering operations, on this forest, except in one very small locality, prevented anything like complete or average growth values from being obtained, and in the absence of such information any plan must be more or less fragmentary and furnish at best unreliable results. It appears then that a rotation scheme of management had best be deferred until after the first cutting when more reliable information concerning the growing stock and accurate growth figures can be obtained to furnish a sound basis upon which a plan for future management can be formulated.

The annual cut in the past has been very small, only such material being exploited as would supply the local settlements with rough lumber, fuel and fencing material amounting to 75 - 100 thousand bd. feet a year.

The future annual out is a difficult matter to determine, since it depends upon so many uncertain and variable factors. Setting aside the rotation idea for the present, the needs of the forest would best be served by outling the total area over lightly, leaving much thrifty merchantable timber to form a substantial basis for a second cutting to follow after

the forest is once completely cut over.

Chapter VI.

THE ESTIMATE

In beginning the field work the corner of a patented mining claim, the approximate location of which was known, was taken as the starting point. From this corner a line was run due west one and a quarter miles, establishing a base line from which a line was run by solar transit north and south through the approximate center of the timbered area. From this line, lateral compass lines were run east and west at three mile intervals, section corners and quarter corners were established and marked on compass lines. Only section corners were established on the base line: It was not expected that this survey would exactly coincide with an official survey when made. So when the work of gruining and mapping was finished, this survey was tied into the Arizona Utah boundary line.

This survey was not done atl at one time, but as soon as necessary lines were run the estimating was taken up. The crew therefore was alternating every few days between running lines and estimating timber. This made the work progress only about half as fast as would be the case were the country surveyed. In June a special crew composed of temporary men in charge of a Ranger, were employed to run compass lines; this helped along the work of estimating very much.

The estimating lines or strips were run twice through each section half way between the section corner and quarter

corner. These strips are two chains wide, thereby embracing an actual estimate of 8 acres in every quarter section. In other words, as actual estimate was made of 5% of the entire timbered ares.

The estimating was done by crews of two men each. one man running compass, pacing and taking topography, the other man doing the estimating. Yellow Pine was estimated down to and including 18" D.B.H. All other species were estimated down to and including 14" D.B.H. In making the estimate the diameter Breast high of the trees was taken in two inch classes. The contents of the trees were then computed at the close of the day's work from volume tables. The table used in computing the pine was the Western Pine table constructed by Mr. Woolsey for the Coconino National Forest. Spruce was computed from Englemenn Spruce tables prepared for the Uinta National Forest, and Fir was computed from Donalas Fir tables prepared on the Targhee Forest. If after logging is commenced, it is found that these tables do not apply, a correction factor can be applied and the estimate corrected accordingly. Stand tables were prepared for each type. In making these stand tables, all trees above 6" D.B.H. were calipered. Saplings and seedlings below 6" D.B.H. were counted and tabulated. The estimate is tabulated by 1/4 weations entirely separate from the report. Only a brief summary of the estimate appears in this report

Summary of Metimates by Townships

	Yellow	:Douglas	Doed :	Total			
<u>.</u>	Fine	: Fir	Fir	Spruce	Hilled:	Dona :	
T.408. R.E E.	9,755					60:	9,815
T.39N.,R.1 E.:	16,495	75			5	550:	17,125
E.39N.,R.2 E.	82,015	410	310		795	1,290:	84,820
T.39N. R.3 B.:	1,520	35	75		74		1,630
T.38N. R.1 W.:	2,085					25:	2,110
T.38H. R.1 B.:	56,320	410	145		80:	1,265:	58,220
T.38H. R.2 E.	73,075	1,630	8,370	115	975	1,070:	79,135
T.38N.,R.3 R.:	1,130	55:	155		201	15;	1,375
T.37N R.1 W.:	27,910				10:	305:	28,225
T.37N R.1 E.:	89,925	1,070	665	315	60:	1,180	93,155
T.37N.,R.E E.	69,415	6,580	10,195	2,840	2,115:	1,390:	92,535
T.37H. R.3 E.:	23,245	1,385	2,340	320	3,090:	85:	30,455
T.36NR.1 W.:	39,410				10:	140:	39,560
T.36N.,R.1 B.:	115,225	2,675	4.155	815	330:	1,265:	124,465
T.36N. R.2 E.:	31,995	13,130:	10,180	3,655	875:	1,230:	61,065
T.35N.R.1 W.:	755	0.000				539	755
T.35N.,R.1 E.	94,510	7,080	5,995	735	305	575	104,200
T.35N.,R.2 E.	44,600	9,545	9,480	4,290	1,355:	565:	69,035
T.35N R.3 E.:	20,110	9,920	10,330	8,610	800:	300:	50,070
T.34H.,R.1 W.	11,280		*	7			11,280
T.34N R.1 B.;	22,175	575	1,300	25	60:	275:	24,410
T.34E.,R.2 E.	85,115	7,110	13,700:	2,160	755:	470:	109,310
T.34N. R.3 E.:	39,400	11,275:	10,930	6,020	630:	295:	68,550

Summary of Estimate by Townships (continued)

	Yellow : Pine :	Dougles Fir	ft. B.M. White:	Spruce:	Bug :	Dead :	Total
T.34R. R.4 E.	11,375	7.225	11,345	1,445	125	790:	32,305
T.33E. R.2 R.:	11,110	40	100:		- 1	155:	11,405
T.33N. R.3 E.:	49,305	8,640	3,725	730:	201	350:	56,770
T.33H.,R.4 B.:	33,745:	1,365	4,085	55	725:	55:	40,030
T.33N.,R.5 E.:	445		20:			:	465
T. SEH R. 4 E.:	5,635				25:		5,660
T.SEN R.5 R.	1,465:				;	25:	1,480

Total

:1,101,735:86,795 :108,860:54;715:16,150:13,875:1,362,130

APPENDIX

Porest

Map

This appendix comprises the Forest Map. The original map of the timbered area was done by townships on a scale of 4" - 1 mile. This scale was thought to be too large for general use, but would be very handy in planning timber sales, etc. 50 a map of the entire forest on a scale of 1/2" = 1 mile was compiled from these township plats and Geological Survey sheets, this map forms a part of the report. The township plats will be held for the use of the District office. The different classes of land shown on the map are fully described under Chapter III. This map is very easily deciphered if it is borne in mind that there are three types represented thereon. Pure yellow pine. open grass land and spruce balsam or mixed type.

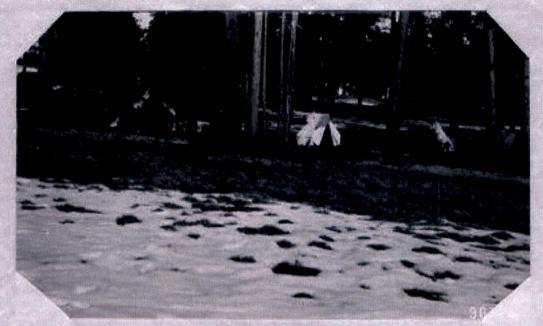


Photo. 90709.

Camp scene early in Marh.